



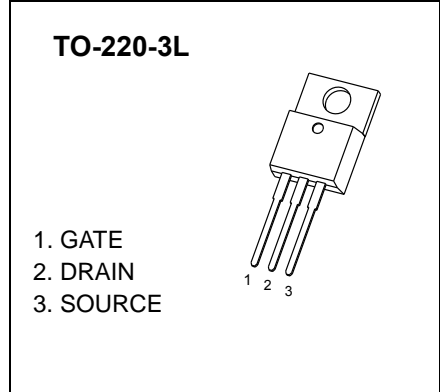
TO-220-3L Plastic-Encapsulate MOSFETS

CJP12N65M1 N-Channel Power MOSFET

| | | |
|---------------|-----------------|-------|
| $V_{(BR)DSS}$ | $R_{DS(on)TYP}$ | I_D |
| 650V | 0.67Ω@10V | 12A |

GENERAL DESCRIPTION

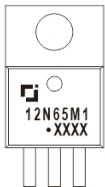
This advanced high voltage MOSFET is designed to stand high energy in the avalanche mode and switch efficiently. This new high energy device also offers a drain-to-source diode fast recovery time. Designed for high voltage, high speed switching applications such as power supplies, converters, power motor controls and bridge circuits.



FEATURE

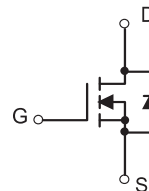
- High Current Rating
- Lower $R_{DS(on)}$
- Lower Capacitance
- Lower Total Gate Charge
- Tighter V_{SD} Specifications
- Avalanche Energy Specified
- Fast Switching Capability

MARKING



12N65M1 = Device code.
 Solid dot = Green molding compound device,
 if none, the normal device
 XXXX=Code

EQUIVALENT CIRCUIT



MAXIMUM RATINGS ($T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|---|-------------------|------------|------|
| Drain-Source Voltage | V_{DS} | 650 | V |
| Gate-Source Voltage | V_{GS} | ±30 | V |
| Continuous Drain Current | I_D ① | 12 | A |
| Pulsed Drain Current | I_{DM} ①② | 48 | A |
| Single Pulsed Avalanche Energy | E_{AS} ③ | 400 | mJ |
| Power Dissipation | P_D ① | 125 | W |
| Thermal Resistance from Junction to Ambient | $R_{\theta JA}$ ⑥ | 62.5 | °C/W |
| Thermal Resistance from Junction to Case | $R_{\theta JC}$ ① | 1.0 | °C/W |
| Operating and Storage Temperature Range | T_J, T_{STG} | -55 ~ +150 | °C |

MOSFET ELECTRICAL CHARACTERISTICS

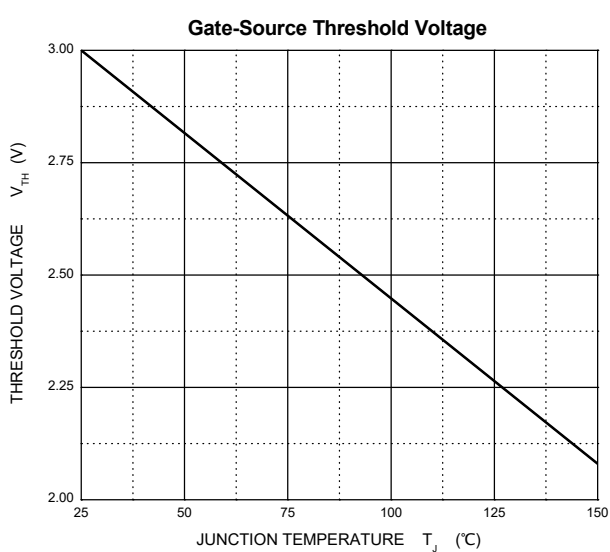
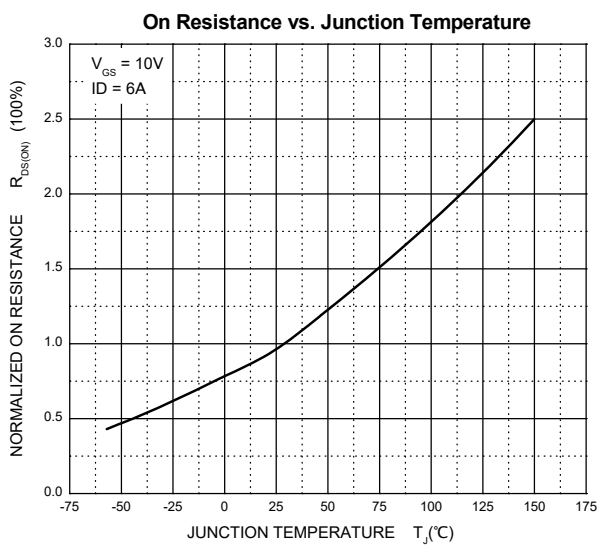
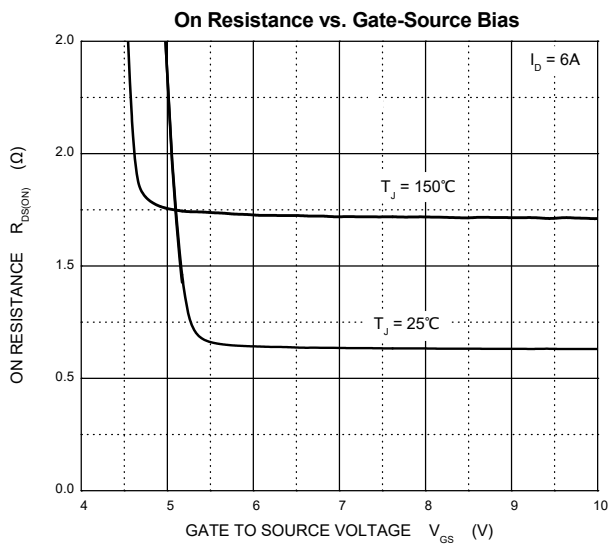
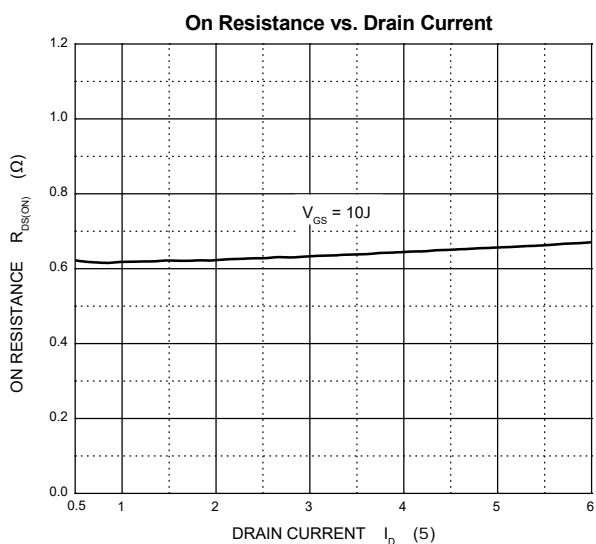
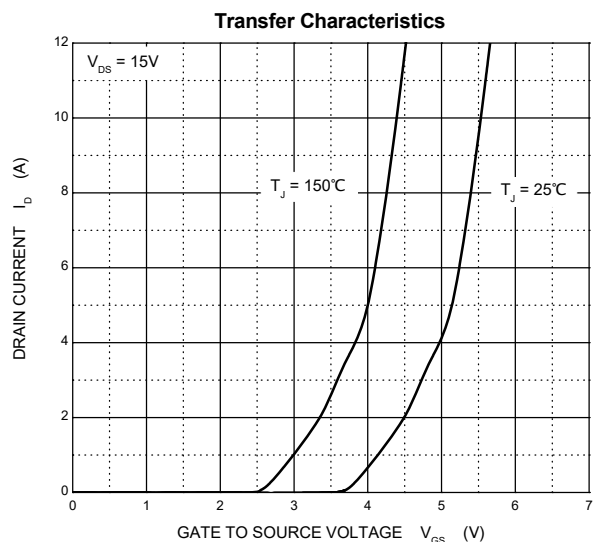
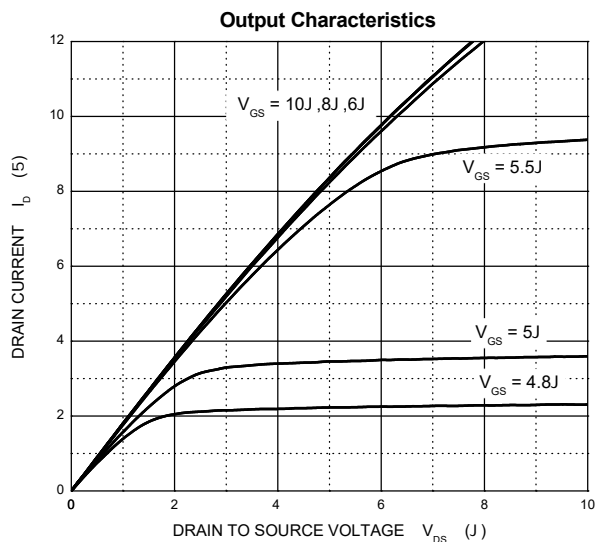
$T_J=25^{\circ}\text{C}$ unless otherwise specified

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit | |
|---|------------------------|---|---------------------------|------|-----------|----------|---------------|
| Off characteristics | | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = 1mA$ | 650 | - | - | V | |
| Zero gate voltage drain current | I_{DSS} | $V_{DS}=500V, V_{GS}=0V$ | $T_J=25^{\circ}\text{C}$ | - | - | 1.0 | μA |
| | | | $T_J=125^{\circ}\text{C}$ | - | - | 100 | |
| Gate-body leakage current | I_{GSS} | $V_{DS} = 0V, V_{GS} = \pm 30V$ | - | - | ± 100 | nA | |
| On characteristics ^④ | | | | | | | |
| Gate-threshold voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\mu\text{A}$ | 2.0 | 3.0 | 4.0 | V | |
| Static drain-source on-resistance | $R_{DS(on)}$ | $V_{GS} = 10V, I_D = 6A$ | - | 0.67 | 0.8 | Ω | |
| Dynamic characteristics ^⑤ | | | | | | | |
| Input capacitance | C_{iss} | $V_{DS} = 50V, V_{GS} = 0V, f = 1\text{MHz}$ | - | 1900 | - | pF | |
| Output capacitance | C_{oss} | | - | 103 | - | | |
| Reverse transfer capacitance | C_{rss} | | - | 2 | - | | |
| Gate resistance | R_g | $f = 1\text{MHz}$ | - | 5 | - | Ω | |
| Switching characteristics ^⑤ | | | | | | | |
| Total gate charge | Q_g | $V_{DS} = 50V, V_{GS} = 10V, I_D = 12A$ | - | 30 | - | nC | |
| Gate-source charge | Q_{gs} | | - | 8 | - | | |
| Gate-drain charge | Q_{gd} | | - | 12 | - | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}=250V, V_{GS}=10V, R_G=10\Omega, I_D = 12A$ | - | 17 | - | ns | |
| Turn-on rise time | t_r | | - | 23 | - | | |
| Turn-off delay time | $t_{d(off)}$ | | - | 41 | - | | |
| Turn-off fall time | t_f | | - | 19 | - | | |
| Drain-Source Diode Characteristics | | | | | | | |
| Drain-source diode forward voltage | V_{SD} ^④ | $V_{GS} = 0V, I_S = 12A$ | - | - | 1.2 | V | |
| Maximum continuous drain-source diode forward current | I_S ^① | | - | - | 12 | A | |
| Maximum pulsed drain-source diode forward current | I_{SM} ^{①②} | | - | - | 48 | A | |
| Reverse recovery time | t_{rr} | $dI_F/dt = 100A/\mu\text{s}, I_S = 12A, V_{DD} = 50V$ | - | 391 | - | ns | |
| Reverse recovery charge | Q_{rr} | | - | 4528 | - | nC | |

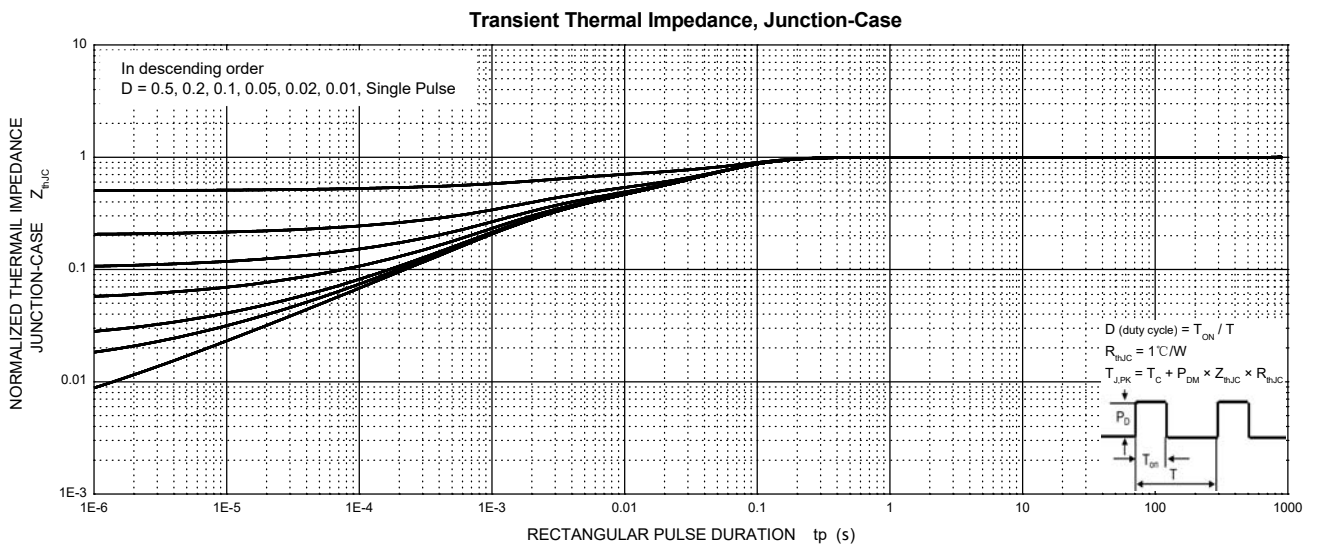
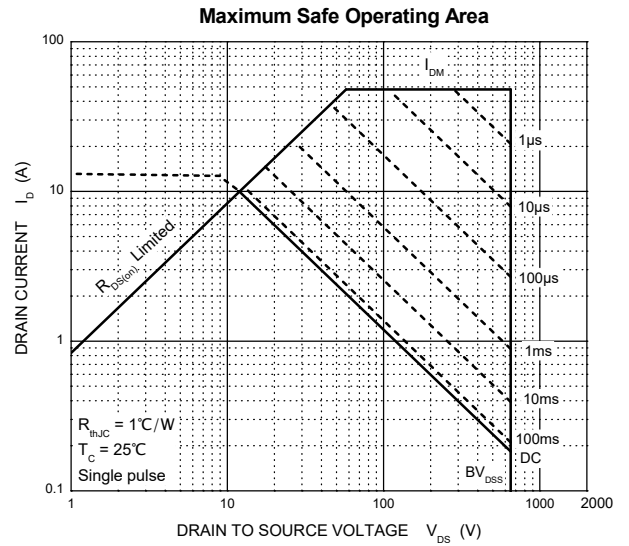
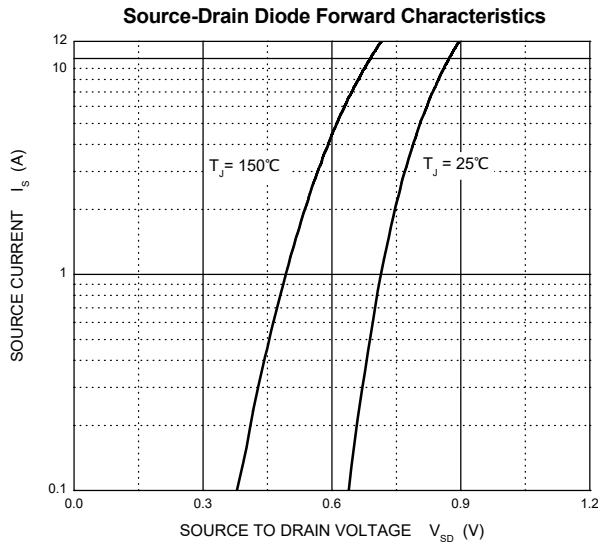
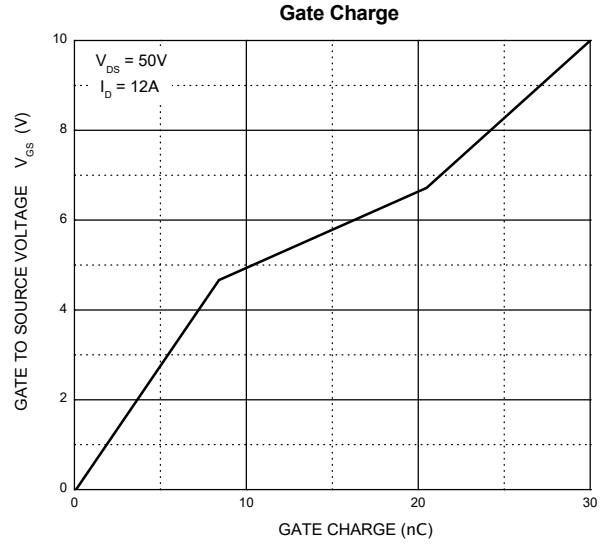
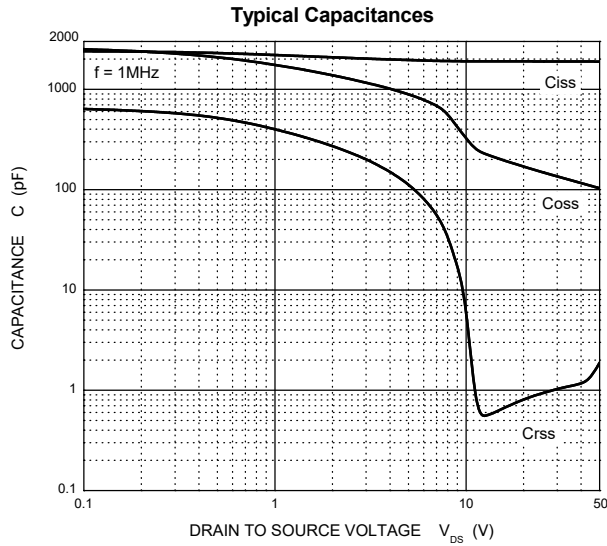
Notes :

- $T_C=25^{\circ}\text{C}$ Limited only by maximum temperature allowed.
- $P_W \leq 10\mu\text{s}$, Duty cycle $\leq 1\%$.
- EAS condition: $V_{DD}=50V, V_{GS}=10V, L=10\text{mH}, R_g=25\Omega$, Starting $T_J = 25^{\circ}\text{C}$.
- Pulse Test : Pulse Width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
- Guaranteed by design, not subject to production.
- The value of $R_{\theta JA}$ is measured with the device in a still air environment with $T_a=25^{\circ}\text{C}$

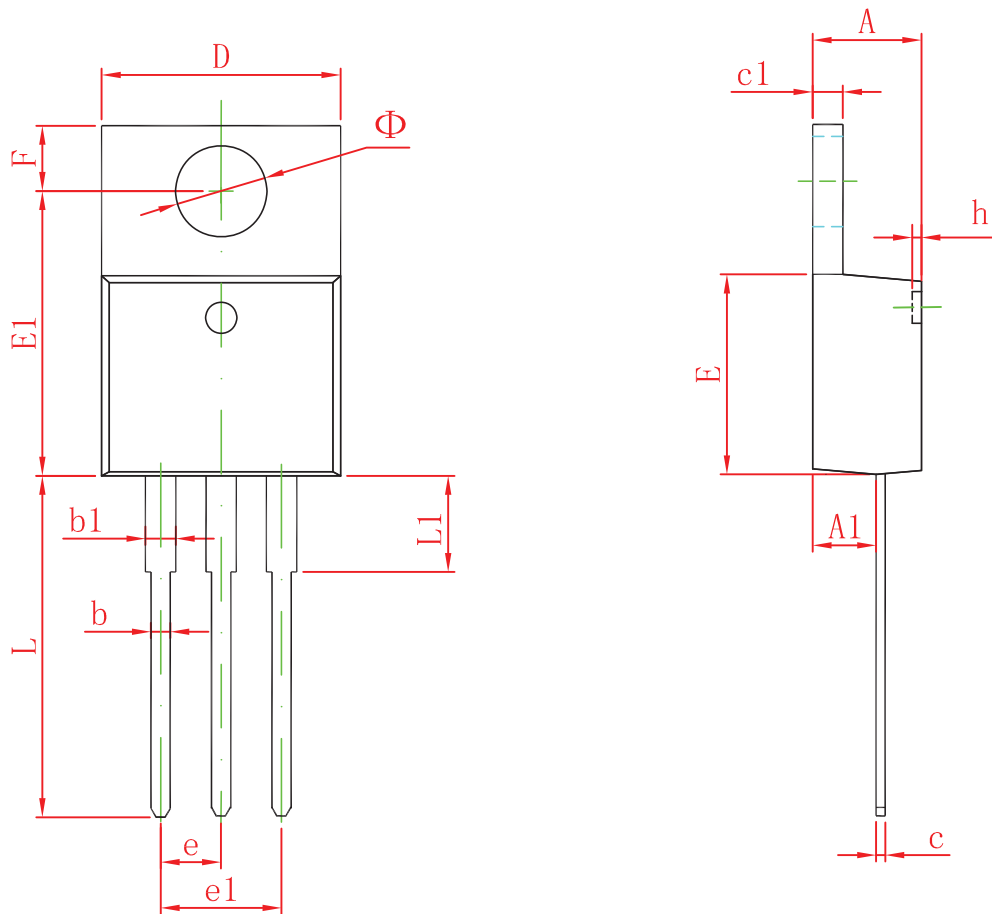
Typical Characteristics ($T_J = 25^\circ\text{C}$, unless otherwise specified)



Typical Characteristics ($T_J = 25^\circ\text{C}$, unless otherwise specified)



TO-220-3L Package Outline Dimensions



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|--------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 4.450 | 4.750 | 0.175 | 0.187 |
| A1 | 2.520 | 2.820 | 0.099 | 0.111 |
| b | 0.710 | 0.910 | 0.028 | 0.036 |
| b1 | 1.170 | 1.370 | 0.046 | 0.054 |
| c | 0.300 | 0.500 | 0.012 | 0.020 |
| c1 | 1.170 | 1.370 | 0.046 | 0.054 |
| D | 9.830 | 10.330 | 0.387 | 0.407 |
| E | 8.500 | 8.900 | 0.335 | 0.350 |
| E1 | 12.050 | 12.650 | 0.474 | 0.498 |
| e | 2.540 TYP | | 0.100 TYP | |
| e1 | 4.900 | 5.200 | 0.192 | 0.205 |
| F | 2.540 | 2.940 | 0.100 | 0.116 |
| h | 0.100 TYP | | 0.004 TYP | |
| L | 13.300 | 13.800 | 0.523 | 0.543 |
| L1 | 3.540 | 3.940 | 0.139 | 0.155 |
| Φ | 3.735 | 3.935 | 0.147 | 0.155 |